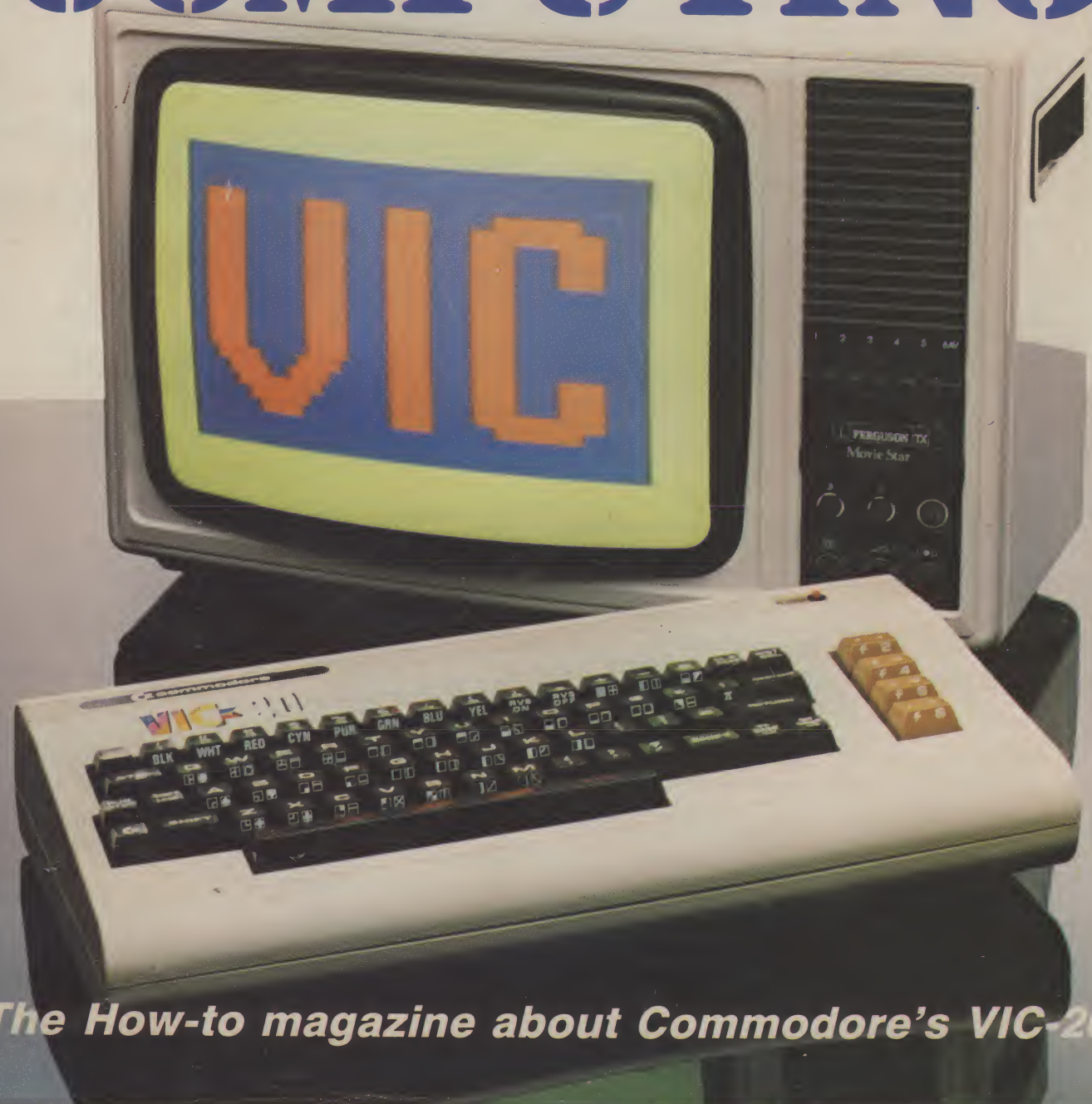


Christmas 1981

95p

VIC COMPUTING



The How-to magazine about Commodore's VIC-20

the vic centre

Adda Computers Ltd., a major supplier of computer systems to industry and business, have opened the Vic Centre in West London. Here you can see, discuss and buy everything to do with the new VIC 20 personal computer—in person or by mail. Hardware, software, technical advice and information is available from an experienced staff of experts. Even if you already own a VIC 20, get on our mailing list to know about new developments. Remember—everything has the backing of Adda's reputation, and there's a full 12-month warranty on all hardware.

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Not just a computer but a whole expandable system

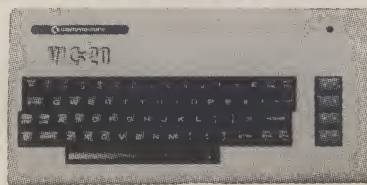
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The VIC 20 is a fully-fledged, easy-to-use computer. It's the core of a great expandable system, with full-size keyboard operation. First-time users can work it immediately with plug-in program cartridges, using your own colour TV to get up to 24 colours on screen, and three different sound tones. Or write your own programs in BASIC. The VIC 20 lets you build a system as needs and budget dictate. You can expand its memory to 32k Byte with Plug-in modules, and transfer data to external storage units. So the VIC 20 is more than just a personal computer—and its system will expand to put it even further ahead.

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VIC ROM SWITCH BOARD £40.25 incl VAT.

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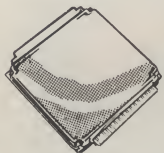
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FEATURE. Plug-in zero force sockets are available as optional extras to help eliminate pin damage to valuable ROMs.

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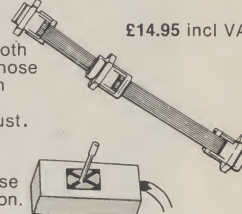
games port plug. A two into one adaptor for use with both joysticks and light pens. A must for those who require full control of games with graphics.

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VIC COMPUTING

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NEWS

Software Snowballs

Six weeks ago the Editor's attempts to review the full range of available VIC programs hit a snag. There wasn't any. (Come to that, there weren't many VIC's either.)

Yet as we go to press the desk upon which the Editor rests his Reagan-style cowboy boots is almost buried beneath a mountain of software announcements.

The most interesting of these is *VICWriter*, a word processing package Commodore plan to release both as a plug-in ROM (Read Only Memory) cartridge, and on floppy disk. It will be a real time saver to anyone who writes letters, whether from home or office. I hope to be able to get my Christmas car list on it in time for the Post Office's deadline. You will probably have to wait for the official release in January. A second version comparable with the planned 40-column wide screen card should be available in February. More about it then.



VIC Printer

Alas Commodore's model 1515 printer had a bug in it when the first batch arrived from Japan. Which was a pity because it looks like a nice machine.

The good news is that Boffin-in-Chief, Dave Briggs has located the bug and is replacing the chip which harbours it. Ergo supplies should shortly be on their way to the dealers, who will be selling it at £230 VAT inclusive.

The main points to bear in mind are that the 1515 plugs directly into the back of the VIC, and will print all of the special characters. Other printers cannot necessarily do this, and may require an additional interface.

The printer uses an ingenious mechanism to print characters on a matrix of 5x7 dots – using only a single print needle – and at a speed of 30 characters per second. 80 columns are provided – which will make program listings a lot easier to read than on the 22-column screen – and the tractor mechanism copes with holed paper from 4.5 to 8 inches (though annoyingly *not* the standard 8 1/4" size).

If you are new to computing, a good place to start could be *'Teach Yourself to Program'*, a package consisting of a 160-page manual and two cassettes of example programs. It costs £14.95 from Commodore dealers. We hope to review it in the next issue.

Audiogenic are well known to PET lovers as purveyors of recordings varying from Heavy Metal to Space Invaders. First VIC offerings are a range of ten cassette based programs retailing at £6.95 each.

What's left of our minds was suitably boggled by the titles: *Robot Blasters*, *Spiders of Mars* and, would you believe, *3-D Invaders*.

We'll be taking a close look at Audiogenic's *VICalc* program (not to be confused with *VisiCalc*), which enables VIC to be used as a sophisticated programmable calculator. Meanwhile you can get further details from P.O. Box 88, 34-36 Crown Street, Reading.

As well as the complete VIC range of alphanumeric and graphic characters, the 1515 also permits double-width text and a user-definable character.

Indeed, for such a small machine the VIC printer is quite a sophisticated little beast. Couple the aforementioned features with variable line feeds and absolute dot-position address and there is no reason why you shouldn't reproduce your best game of Space Invaders in minute detail – on paper!

Floppy Disk Imminent

What you may wonder does Commodore's VIC department do when it is not playing snowmen with mountains of orders (nearly 20,000 at the last count)?

Some at least of the time has been spent playing – sorry, testing – the still-secret model 1540 floppy disk drive. This is a device which enables a computer to search through quite large amounts of information very quickly. It costs more than a cassette recorder, but it is much faster and for business use it is a must.

At any one time the VIC can access up to 170K bytes of information stored on its single drive. That's the equivalent of some 20,000 words of text!

To do this the drive unit has its own permanent Read Only Memory (ROM) containing the Disk Operating System, (DOS). So, unlike most other computers, it won't eat up any of your precious RAM memory.

The VIC 1540 disk drive has DOS 2.7 which is similar to that used by the PET 4040 disk unit. In fact, they are compatible, and it is possible to load a disk prepared on a PET 4040 on the VIC 1540 drive.

In appearance the VIC 1540 is lower in profile than the single PET drive, and in our opinion, rather better looking. As you would expect, the plastic casing matches the VIC. A second drive can be connected without difficulty.

Supplied with it will be the DIN lead which connects directly to the back of the VIC, and a utility disk that includes a directory program and various test routines.

No price yet, but it should be below £400 including VAT; possibly quite a lot below. A review is planned in the next issue.

VICs Talk on Telephone

A VIC modem has just gone on sale in the USA. This converts the computers electronic signals into audible pulses which can be sent down a telephone line. A modem connected to a computer at the other end converts the audio pulses back into a form the computer can understand. Commodore UK are believed to be testing low-cost modems for use with the British telephone system.

Also on sale in the U.S. is a speech synthesis unit from Commodore priced at \$395 (about

£220). The synthesiser uses phonemes, the basic elements of speech; these are stored on disk. Users can define their own sets of words, but the packaged comes with a wide variety of samples. Our correspondent reports that "it sounds like nothing on earth."

A better bet is the *Type 'n Talk* synthesiser from Votrax which Commodore UK have been testing. A full report on this and other similar devices appeared in the October issue of our sister magazine, *MicroComputer Printout*.

START RIGHT

The thing looks like a pre-pubescent typewriter. Come Saturday, you give your wife a ticket to the matinee, send her on her way, plug all the bits together, turn it on, and your colour TV screen lights up with a message from the manufacturer to show that everything is working the way it's supposed to be.

"Yes, but what does it doooo?" says Aunt Tillie. The thing is, all other machines are designed to do one job. I mean, dish washers wash dishes, and clothes washers wash clothes, but never the twain, as wotsisname said. But a computer does whatever its program tells it to, and you can change the program as easily as changing a cassette. Try explaining that to Aunt Tillie, though! Depending on what you want to do with it, you can buy bits that plug into the back to give you sets of games, home finance, picture-drawing and noise-making aids, and ask-your-dealer-what's-new-this-week!

Blinking Blocks

I had mine first without any plug-in-the-backs or cassettes, just to see what it would do stripped naked, so to speak. It has all the usual typewriter keys along with some new ones. You can't say it's like a typewriter, though, because it's got no type slugs to

tangle up nor paper nor carriage. Instead, a blinking block shows where the next letter you hit will print on the telly. If you want to erase the whole screen, you hold down SHIFT and hit the key marked CLR (short for CLEAR) at the top. Without SHIFT, the same key gets you HOME which simply means that it puts the blinking block in the upper left corner.

Write a few words and make a mistake (on purpose, if you have to.) Hit the key marked DEL (DELETE) and watch the letter to the left of the blinking block disappear! Typewriters were never like this. Hold DEL down and it repeats and starts erasing back to the left as far

by Martin Jacobs

as you want. If you want to go back without erasing, use the key marked CRSR (CURSOR) with left and right arrows. CURSOR is the proper name for the blinking block, from the Latin for somebody who runs around a lot.

Hold down SHIFT and hit the CRSR key to move to the left without erasing. Type over your mistake to correct it, or use SHIFT and INST (INSERT) to open up spaces if you need to! If you go past the end of a line, you don't have to do anything. VIC will automatically start the next line. You can use CURSOR RIGHT (CRSR without SHIFT) to move right without erasing. If you want to erase to the right, hold down the long SPACE key. It will begin to repeat, and the cursor will move along to the right, erasing anything under it by writing spaces. The cursors don't erase because they don't write spaces.

There is another cursor key with up and down arrows, and I suspect it doesn't need Dr. Who to tell you that this will move the cursor DOWN or, with SHIFT, UP! A bit of orl

right, wot? One thing, though: when you get to the bottom of the screen, if you type another line all the lines on the screen will move up to make room, and the top lines will disappear. There's no way to get them back at this point in the proceedings.

Return

The key marked RETURN is something like the carriage return on a typewriter, but different. If you hit RETURN, the computer thinks you are trying to tell it to do something. If you typed MABEL and hit RETURN, the computer would type back at you and say ?SYNTAX ERROR and READY, which just means that MABEL is not a word the computer recognises today. Understand, it's not the end of the world if you do something that causes the computer to snap at you. There's no way you can hurt anything. I mean, don't pour orange juice on the keys, but aside from that! So use MABEL if you want, but don't use RETURN yet, until you learn a few computer commands.

Right now we are just playing around with the keys still, so if you want to start a new line,



HERE



hold SHIFT and then hit RETURN, and the blinking block will zip to the left and down one and the computer will know you are just playing around, as SHIFT RETURN isn't the same as RETURN. Use it twice to put a blank line between lines of letters.

Over in the lower left there is a key marked with the hieroglyph of the Great and Good Commodore Computer Company. This works like a special shift key. Let's call it the CHIFT key. Notice that all the letter keys have two special characters engraved on their front edges. These can be used to draw boxes, pictures, and patterns and to be the pieces in games, another thing you don't get in typewriters! A lot of them are designed to connect together when printed side by side or one under the other. The ones on the left hand side of each key are got by holding down CHIFT and hitting the key. The ones on the right are got by holding down SHIFT and hitting the same key. When it works like this, you are in the Graphics Mode, but there is another Mode which you use when you want to get both capital letters and lower case letters. You get into this mode by pressing both CHIFT and SHIFT at the same time. The letter keys will now give lower case letters, SHIFT will give capital letters like a normal typewriter, and CHIFT will give its special graphics symbols, but the graphics symbols on the right of each key are not available. In fact, if any of these were on the screen when you changed modes, they will all change to capitals! To get back to Graphics Mode, hit SHIFT and CHIFT together again.

Colour

What about colour? The easiest thing to try for a start is to draw coloured stripes. Hold down the SPACE key and see how it repeats and the cursor moves across the screen from left writing invisible blank spaces. Now find the CTRL (CONTROL) key under the upper left corner. Hold it down while you press the 9 key, also marked RVS ON (REVERSE ON). You have just turned REVERSE ON, which we will translate into ordinary English in a moment. The CONTROL key works with the keys marked 1 through 0 to give you the function engraved on the front of each key. When you do CONTROL 1 or CONTROL 5, etc., it doesn't print anything on the screen; it just sets it up for something.

CONTROL REVERSE ON means that whatever colour the letters and background had before will now be reversed on all subsequent letters. If it was blue letters on a white background, which is what you get when you first turn on the VIC, it will now be white letters on a blue background, and so on, but the letters you have already typed won't change. CONTROL REVERSE OFF takes you back to blue letters on white, or whatever you had before. CONTROL 6 (GREEN) will change subsequent letters to green, CONTROL 3 to red etc., and you can accordingly make each letter a different colour if you like.

CONTROL 2 will make white letters on what happens to be a white background at the moment, though, which is the next best thing to invisible, so there's no point in using it until you learn how to change the background col-

our. With RVS OFF (the normal condition), the SPACE key writes white spaces on a white background. With RVS ON, however, it writes "blue spaces", or whatever colour you have selected, so you can use this to draw in colour. Use the CURSOR UP, DOWN, LEFT, and RIGHT keys to move to where you want to draw a coloured blot; use CONTROL and a colour key to change the colour if you wish; and hit the SPACE key to draw the blot or hold it down to draw a continuous stripe from left to right. Using RETURN or SHIFT RETURN has the secondary effect of turning REVERSE OFF automatically, so don't be surprised if you do and it does.

Can't because you don't have a VIC? The thing to do at this point is to run out and borrow, steal, or even buy one so that you can try all these operations out and get familiar with them. You don't have to be able to type at all. Even with only one working finger on each hand I can get the VIC to do whatever I want very quickly, and every day I get faster. We haven't talked about the RUN-STOP key or the F1 through F8 keys over on the right, but you don't need to know about these to have fun doodling and, if you get your own VIC, the little book of instructions that comes with it will explain these and many other things as well. So far we haven't really used the computer at all. We've just used the keyboard to write on the screen. Wait 'till you see what the computer will do!

Martin Jacobs continues this series in the next issue.

**To: ACT Microsoft Ltd.,
ACT House,
111 Hagley Road,
Edgbaston,
Birmingham B16 8LB**

Dear Sir,

**Please send me details of your
exciting new programs for the VIC.**

Yours faithfully,

Name:
Address:
.....

Dear Vic,

VIC into PET won't go

I read in your magazine that VIC's BASIC is pretty well compatible with the PET, and that both use the same cassette recording format. However, when I try to load some of my VIC programs onto the PET in our office (in an attempt to list them on the printer) I don't seem to get anything. Why is this?

P. Croxford

The trouble here is that unless your VIC has extra memory fitted, programs start at memory location 4096; however, the PET expects them to start at location 1024; being but a dumb animal, it looks there, finds nothing and gives up. The trick is to insert a dummy line such as 0 REM and to arrange for the pointers associated with that line to point to the start of the real program. To achieve this, proceed as follows:-

1. LOAD the VIC program into the PET.
2. Enter the monitor with a SYS 1024.
3. Display the first few locations from 1024 onwards (hex \$400) by typing:

```
.M 0400,0407
```

4. Use the editing functions to change the locations to:

```
.. 0400 00 01 10 00 00 8F  
00 00
```

Pressing Return and then .X Return will alter those locations and return to BASIC.

5. You may now type LIST to show your program, along with the dummy line zero.
6. Deleting line zero will relocate your VIC program to the start of PET's memory.

This very useful technique not only allows you to LIST programs on your PET system, but also means that you have access to the vast number of program utilities (such as the Programmer's Toolkit) which are available on the PET.

Note: When you add a 3K expansion pack to the VIC, program storage starts at 1024, which is the same as the PET. The VIC's operating system, however, includes a relocating loader so that your existing software will not be rendered useless.

Joystick blues

As a proud new VIC owner, I wondered if you could answer the following points for me:

1. The bottom pins on the User port appear to be the same as the PET for which I have made several relay units. Can you tell me the POKE and PEEK numbers for the 8 lines?
2. I have an Atari joystick and 9-way Cannon plug, can one PEEK at this port to find out where the stick is, if not, what is the software?
3. Will there be soon a programmers handbook?

4. If any wants to form a North London VIC group could they let me know.

Many thanks in advance.

J.W. Chambers,
12 Sylvan Avenue,
Finchley,
London N3 2LE

Thinking cap on. Deep breath. Here goes:

1. Yes. The VIC user port is much the same as PET's equivalent, although it also doubles up as the serial printer interface and IEEE as well. The location for PEEKing the values on the pins is 37136
2. The Atari joysticks appear to be compatible with VIC's game control port. You can inspect the position of the joystick by PEEKing locations 36872 and 36873 which are two of the control registers in the VIC chip itself. These two will give the relative X and Y co-ordinates of the stick.
3. A programmer's reference guide has been written for the VIC, containing everything from memory maps to details of the VIC chip itself. So far this has only been made available to dealers, though Commodore apparently have plans to market this later. Nick Hampshire (author of best selling book The PET Revealed) is already well advanced on the production of The VIC Revealed - an independent source book.

Colour blind?

I think it's time someone spoke up about the grossly misleading ads which claim 24 colours for the VIC. I'm not just objecting to counting black and white as colours, although I was taught in school that black is the absence of colour and white is the effect of light of all colours mixed. I'm objecting because there are not 24 different colours: there are six basic colours (red, cyan, purple, green, blue, and yellow) plus black and white and there are eight derivative colours (light cyan, light purple, light green, light blue, light yellow, light orange, orange, and pink). The basic colours can be applied to characters, screen background, or the border area (where characters cannot be written). The derivative colours can only be applied to the screen background. The only fair way to describe this is 'fourteen colours plus black and white'!

Of course the problem is that the competition (did I hear someone whisper 'Atari'?) actually has a larger range of hues which can be specified for any part of the screen and which are available in any of eight illuminance levels. May the best man win, but I will vote for honest specs every time!

Lindsay Doyle,
Connecticut, USA

I think we can acquit the Commodore on this one. What the ad actually says is "16 screen

colours and 8 border colours." Seems clear enough to us.

VIC Talks

Will it be possible to produce speech on the VIC-20?

P. Kaye

The VIC contains three independent frequency generators, as well as a white noise source. In theory it should be possible to produce a very crude form of speech synthesis through the T.V. speaker, though the results will probably not be too aesthetic. We will certainly publish a listing, if anyone can write a program that says something intelligible. First prize is lunch with John Baxter. Second prize, two lunches.

The VIC does contain the software to drive an RS232 port, however, and you can purchase an adapter for less than £20 that will convert the voltage levels, and change the connector.

Several good quality speech synthesisers are now appearing on the market, and will plug directly into an RS232 port. The best of these is the Votrax Type-'n-Talk which uses a text-to-speech algorithm to convert whatever you type on the keyboard into speech. The price should be around the £150 (+ VAT) mark.

Auto Start

I recently had the chance to play with one of the game ROM packs on the VIC in my dealers. I noticed that even if you switch off and then on again, the game automatically starts - without the need to type RUN as with normal programs. How does this work, and can I get my own cassette programs to RUN automatically?

M. Butterworth

All microcomputers have what is called an initialisation routine which is activated when the power is first switched on. This checks out how much memory is available, sets up various pointers and routines in memory and then jumps to the BASIC interpreter to await a command or program to be entered. On the VIC, however, it first checks some locations in the expansion ROM area. If the correct sequence of characters is found, then it will jump directly to this expansion ROM, and not to the BASIC interpreter.

Plug-in cartridges can thus be made to run automatically, by including the correct sequence of characters (Hexadecimal 41,30, C3, C2, CD starting at \$A004) in the expansion area of ROM. Unfortunately, this technique cannot be made to work on cassette.

Having said that we are bracing ourselves for a barrage of letters from readers who have discovered a way to do it!



NOW YOU CAN BUY THE BEST HOME COMPUTER IN THE WORLD.

Commodore's brilliant new VIC20 home computer is at your dealer's today. Now you can get your hands on the world's best home computer, we're sure you won't be disappointed.

Here's a brief reminder of VIC's many features:

A typewriter keyboard with graphics.

5K Memory—expandable to 29.5K user RAM.

8 programmable function keys.

High resolution graphics.

Music in three voices and three

octaves, as well as sound effects.

Eight border colours and sixteen screen colours.

All in a superbly-designed, compact unit with built-in facilities for expansion.

Now you can take a look for yourself. And even take VIC home tonight.

 **commodore**
COMPUTER

For more information on the VIC 20, telephone or write to: Commodore Information Centre, Baker Street, High Wycombe, Bucks, or Tel: Slough 79292.

PROGRAM LISTINGS

In each issue of *VIC Computing*, we will be printing program listings for you to type in – games, programming aids and useful subroutines.

To start off with, here are three short programs, specially written by Chris Palmer to show how simple string handling can be used to create some impressive screen displays. They will also serve to introduce four more of VIC's control registers which alter the position and size of the display screen.

Simply type the programs in, and RUN to see the effects. Where a particular line needs further explanation, details are given below.

HYPNOTIC

This program uses 4 of the VIC control registers to alter the size of the screen. They are as follows:-

POKE 36864,0-255 – Controls start off screen from the left.

POKE 36865,0-255 – Controls start off screen from the top.

POKE 36866,0-255 – Number of columns on screen.

POKE 36867,0-255 – Number of rows on screen.

```

1 REM HYPNOTIC
2 REM CHRIS PALMER
3 REM VIC CENTRE
5 GOSUB 3000
10 POKE36878,15
20 POKE36879,INT(RND(1)*128+1)
30 GOSUB1000
40 GOSUB2000
50 GOTO 20
1000 REM CLOSE
1010 FORI=0 TO 22
1020 POKE36877,230+I
1030 POKE36864,12+I
1040 POKE36865,38+I
1050 POKE36866,150-I
1060 POKE36867,174-I*2
1070 NEXT
1080 RETURN
2000 REM OPEN
2010 FORI=22 TO 0 STEP-1
2020 POKE36877,230+I
2030 POKE36864,12+I
2040 POKE36865,38+I
2050 POKE36866,150-I
2060 POKE36867,174-I*2
2070 NEXT
2080 RETURN
3000 FORI=0TO506
3010 POKE7680+I,160
3020 POKE38400+I,INT(RND(1)*2)
3030 NEXT
3990 RETURN

```

LISTING 1 – 'HYPNOTIC'

POLKA

In line 1 the two reverse characters are obtained by typing SHIFT and CLR/HOME and CTRL and BLK.

In line 5 the characters within the quotes are obtained by typing CRSR right.

In line 200 the two characters are CLR/HOME and CRSR down.

You can change the pattern that appears on the screen by changing the arrangement of the dots and the spaces in lines 10, 15, 16, 17, 18, 19.

```

1 PRINT"™"
5 S$="#####1"
7 FORJ=1TO5
10 IFJ=1THENA$="#####"
15 IFJ=2THENA$="###  ###"
16 IFJ=3THENA$="##  ##  ##"
17 IFJ=4THENA$="##  #  #  ##"
18 IFJ=5THENA$="##  #  #  #"
19 IFJ=6THENA$=" #  #  #  #"
20 FORI=1TO10
30 PRINTLEFT$(S$,10-I+1);LEFT$(A$,I);
40 F$=LEFT$(A$,I)
50 FORG=LEN(F$)TO1STEP-1:F1$=F1$+MID$(F$,G,1);NEXT
60 PRINTF1$;F1$=""
70 NEXT
120 FORI=10TO1 STEP-1
130 PRINTLEFT$(S$,10-I+1);LEFT$(A$,I);
140 F$=LEFT$(A$,I)
150 FORG=LEN(F$)TO1STEP-1:F1$=F1$+MID$(F$,G,1);NEXT
160 PRINTF1$;F1$=""
170 NEXT
190 REM FORI=1TO506:POKE38400+I,40R8:NEXT
195 POKE36879,INT(RND(1)*128+21)
200 PRINT"™";NEXTJ:GOTO 7

```

LISTING 2 – 'POLKA'

LINES

In line 1 the two reverse characters are obtained by typing SHIFT and CLEAR/HOME and CTRL and WHT.

In line 5 the variable S\$ contains 19 spaces.

In line 200 the character is obtained by typing CLR/HOME.

The screen pattern can be changed by altering the diagonals in lines 10, 15, 16, 17, 18.

```

1 PRINT"™";POKE36879,8
5 S$=" "
7 FORJ=1TO5
10 IFJ=1THENA$="/////////"
15 IFJ=2THENA$="/////////"
16 IFJ=3THENA$="/////////"
17 IFJ=4THENA$="/////////"
18 IFJ=5THENA$="/////////"
20 FORI=1TO10
30 PRINTLEFT$(S$,10-I);LEFT$(A$,I);
40 F$=LEFT$(A$,I)
50 FORG=LEN(F$)TO1STEP-1:F1$=F1$+MID$(F$,G,1);NEXT
60 PRINTF1$;F1$=""
70 NEXT
120 FORI=10TO1 STEP-1
130 PRINTLEFT$(S$,10-I);LEFT$(A$,I);
140 F$=LEFT$(A$,I)
150 FORG=LEN(F$)TO1STEP-1:F1$=F1$+MID$(F$,G,1);NEXT
160 PRINTF1$;F1$=""
170 NEXT
190 FORI=1TO506:POKE38400+I,10R8:NEXT
200 PRINT"™";NEXTJ:GOTO 7

```

LISTING 3 – 'LINES'

If you have written any programs which might be suitable for publication, please submit them* to the Editor, c/o *VIC Computing*. We pay for all published material!

*Be sure to keep a copy as we are unable to guarantee the safe return of material submitted.

ALTERNATE SCREENS

One of the more exciting things about the VIC is the control you can exercise over the screen. There are many ways you can do this; in this article **Jim Butterfield** demonstrates how to "move" the screen.

The screen itself won't move, of course: it stays wherever you have plunked your TV set or monitor. What we'll be doing is changing the location from which the screen gets its information.

The Screening Process

The information that appears on the screen is taken from the memory of the VIC. Each character on the screen corresponds to a value stored in memory. Each screen location is linked to a specific memory location. Here's the trick we are after: we plan to change the links so that each screen location is fed from a different memory cell.

If we can do this successfully, we'll be able to store two completely separate "screens" in memory. We can then switch the display back and forth between these two screens so as to create special effects or a useful "dual" display.

There is a location in VIC's memory which controls where the screen display is linked to memory. We can easily switch the contents of that location which would cause the screen to flip to the new display. But that's not enough.

Working on the Screen

We must also change the working pointers in the VIC – the ones that put new characters on the screen. It might not help us much if we switched the display to a new location but kept on typing characters into the old one.

Another small job that we will need to do: we must set aside the extra memory we need for the second screen. This will reduce our paltry 3500-odd bytes to less than 3000, but it's a necessary sacrifice. After all, we don't want BASIC messing around in this screen area; and unless we say otherwise, BASIC will use as much memory as it can find.

The first step

Try typing PRINT PEEK(56) and pressing RETURN. You should see a value of 30 printed. Any other value means that your VIC doesn't have the normal 5K of memory, and the rest of this procedure won't work.

The value of 30 tells us the address of the "page" where BASIC stops. A page is a chunk of 256 bytes. We're going to take away two more pages in order to free enough bytes for the second screen.

Type POKE 56,28:CLR and press RETURN. Now we've stolen away five hundred odd bytes from BASIC. If you don't believe it, type PRINT FRE(0) and see. Don't worry too much about the loss. Everything will restore to its normal state when you turn the power off; we're just making a temporary change.

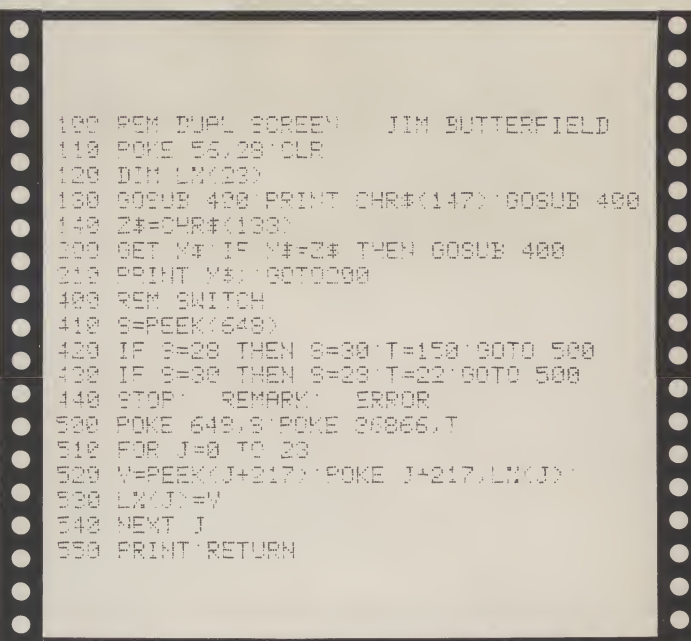
Flipping over

You'll need to type four crowded lines. Excuse the congestion; if I put neat spacing in we couldn't get it all to fit, and then we'd end up stuck halfway between screens. Type the following as a single block without pressing RETURN:

```
POKE36866,22:POKE648,28:
FORJ=217TO228:POKEJ,156:
NEXT:FORJ=229TO240:
POKEJ,157:NEXT
```

Proofread it carefully; one mistake and you'll have to power down and do it all again. When you're sure it's right, press RETURN.

Bingo! You're into the other screen. It looks like a mess, for this screen area was never cleared. Clear the screen and type your name and perhaps one or two other messages; you might like to change the colour of the



characters. Now to prove that we really have two screens. We're going back home.

Type in the following, again as a single block:

```
POKE36866,150:POKE648,30:
FORJ=217TO228:POKEJ,158:
NEXT:FORJ=229TO240:
POKEJ,159:NEXT
```

Proofread, press RETURN, and you're back in the first screen.

Picky stuff

The first annoyance that you'll notice is that right after you switch screens, the VIC prints READY, probably right in the middle of the new screen. This isn't much of a problem: when you write the above statements as a program they will execute without the READY being printed. Another advantage of writing this into a program is that you don't have to crowd everything into a single line.

The second problem is less visible to begin with, but more serious. All the linked lines have been broken apart; instead of one four-row line with our massive POKE sequence on it, we'll have four individual lines. This may not matter on some kinds of display, and might even be nice if we wanted that effect. But we often want to keep the screen exactly as it was when we left it.

The trick is in locations 217 to 240: to restore the screen, we must restore these values exactly as they were. That will take a little extra coding.

A program

Here's a little program to do all the above jobs. We'll use the

VIC's F1 key to switch between screens.

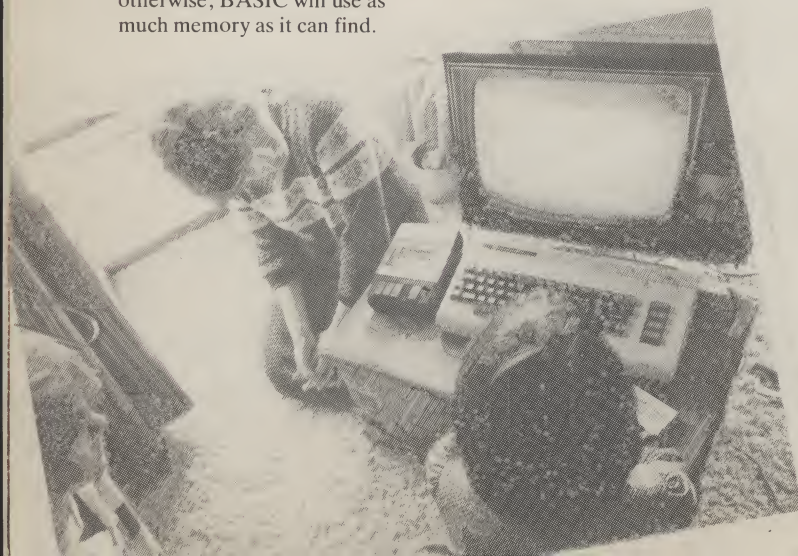
Further thought

It works. Can you have three, four or five screens? There seems to be no reason why not. Unfortunately, you'd need to compromise to make it work; there are only two screen colour tables. We haven't even talked about these – they took care of themselves in our example.

If we omitted the PRINT statement from line 550, we'd find another oddity: the VIC doesn't really switch screens until a line is complete. It doesn't look for a new location to put characters until RETURN or some other event signals the end of a line. We've taken the simple way out here; more elaborate coding would be needed to reinstate the screen in mid-line.

Let's leave this exercise at its present stage of development. It's useful as it stands; it doesn't gobble up too much memory; and it's fairly simple.

For those who need to know mechanisms: 36866 is the location that actually switches the display. 648 tells the VIC where to find the whole screen. The values at 217 to 240 do two jobs. First, they tell the VIC roughly where the screen line is to be found; secondly, they identify whether multiple rows have been linked together to form a long line. I call this series of values "the screen wrap table"; but the name is less important than an understanding of what it does. The colour control locations are at a high location – above 3000 – and happily, we don't need to deal with them here.



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Dear VIC-fan,

Now that VIC is here and on its way to the shops I would like to bring you up to date and explain why it was delayed in the first place.

VIC first went into production in Japan a few months ago, where it rapidly became one of the fastest selling computers ever introduced. We did, however, find that the original power lead bore a close resemblance to those used for shavers. To avoid the possibility of the wrong lead being used, not to mention the resulting blue smoke, we decided it would be better to change the power lead and back panel.

While we were at it we also made some improvements to the colour circuitry, and a few other minor modifications. I think that you will find the results have been well worth waiting for. The colour, which was praised for its clarity when VIC was first introduced, is now even better.

We began shipping VICs to British dealers in mid-October. Due to the massive demand there is still a backlog of orders, so if you have not yet received your VIC, I can only ask you to be patient just a little longer. We really have pulled out all the stops and VICs are now rolling off our new production line in West Germany, with a high proportion of them earmarked for the U.K.

Commodore Systems, 675 Ajax Avenue, Trading Estate,

the Commodore

Happily, the peripheral programme is well on schedule and we expect to start shipping the VIC printer in the near future. We also plan to introduce a low-cost VIC floppy disk drive, and 3K, 8K and 16K RAM cartridges. Incidentally, these will plug directly into the back of the VIC.

Many companies are developing peripherals and software for VIC, and we at Commodore will be supporting them fully. Expect then to see a wide range of programs and plug-in devices during the course of the next few months.

If you develop any interesting or unusual applications, be sure to drop me a line. Meanwhile, good computing!

Yours sincerely,

John P. Baxter

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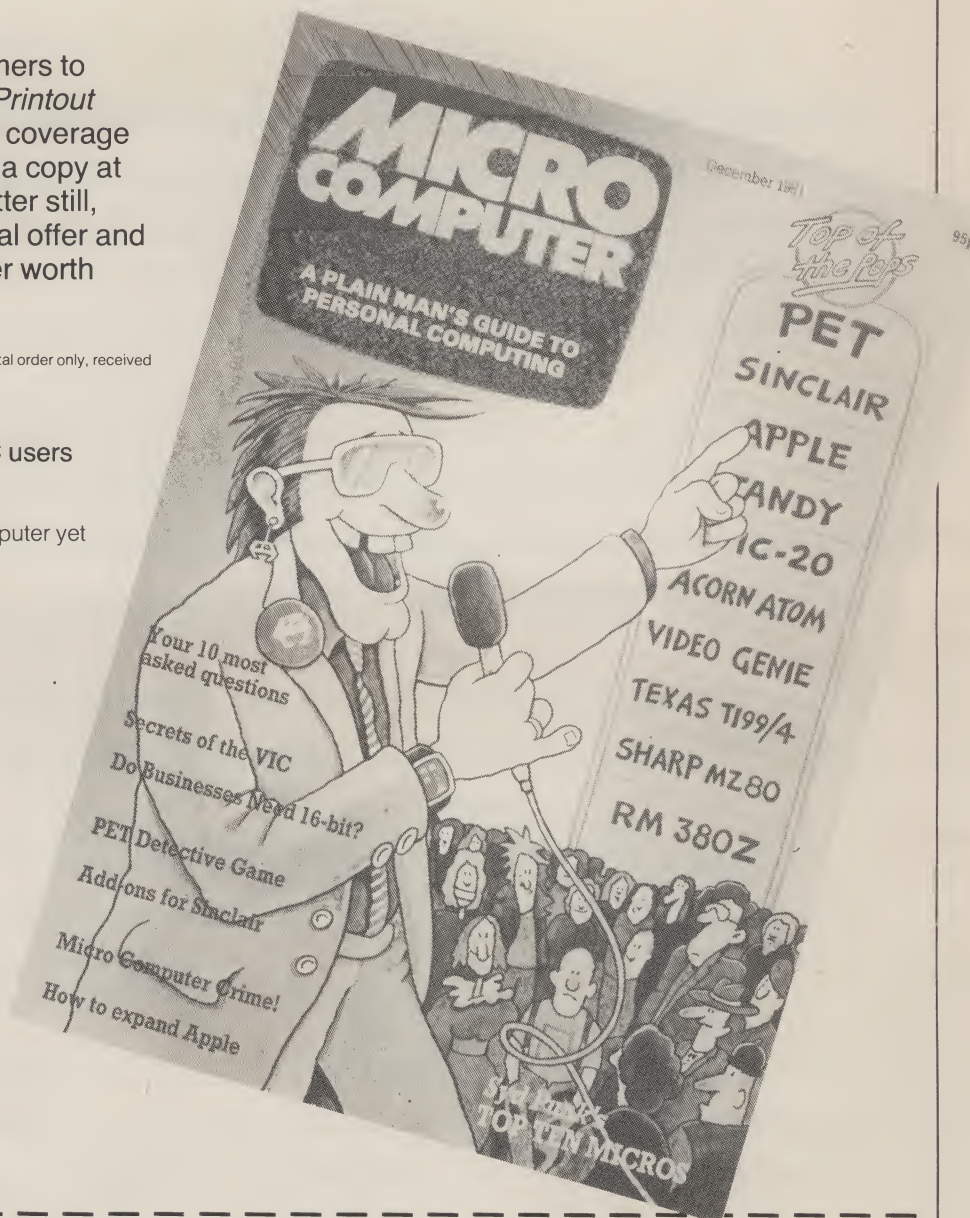
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FREE BINDER

As Chief VIC Boffin of the Independent PET User Group, **Mike Todd** writes a penetrating VIC column in the Group's Newsletter. We asked him to share his thoughts with us...

It's not so long ago that a record in the TOP-40 was echoing the question we were all asking – "Is VIC There?" Well, although Commodore have been slow in getting the VIC up front to match their advertising, at long last VICs are flowing into the country at a reasonable rate. This is being written in October when just over a thousand VICs had arrived from Germany; and by the time you read this there should be more than 7000 VIC users in the UK! My own thoughts are that this is just as well, bearing in mind competition from Atari and the BBC Proton. This latter machine offers extremely good value for money and is only a little more expensive than the VIC – however, it has still to make a formal appearance!

The trade has had pre-production model VICs for some time, and the onslaught of VICs should be met by a wealth of experience in both soft- and hard-ware.

IPUG

So where does the Independent PET User Group stand in all this? We intend to co-ordinate the setting up of regional VIC user groups, initially centred around existing PET user groups. There will also be some financial compensation to assist in setting up regional VIC user groups which has been promised by Commodore. In fact, Commodore are being extremely helpful in this venture and (through IPUG) are offering support in all areas – although you can be assured that we will continue to remain independent! A feature that Commodore themselves appear to welcome. In order to help start this movement, I will be IPUG's VIC "co-ordinator" for the time being and act as a central reference point for VIC correspondence and will see to it that it is pointed in the right direction.

Failings

So to the VIC itself – one has been provided by Commodore and it is available for local groups to borrow. I have been trying it out and my immediate reaction is one of a well thought out machine, well built and apparently reliable but with two major failings. The first and probably most documented is the 22 character wide screen. There appears no logical reason for this decision and it results in difficult-to-read listings, and can cause problems in trying to lay out screen displays. I have no doubt that for games, this restriction isn't too bad, but for anything else I think it is a disaster (and will certainly result in the VIC not taking the market lead as it ought to!) The other failing is the lack of RAM. Only 3.5K is available to start with although a £40 3K add on RAM pack will make up the difference. It is a shame that this RAM isn't included (or at least the facility provided for on-board expansion instead of requiring an add-on pack).

Under the bonnet

Anyway, let's have a look inside. The VIC is supplied with 16K of ROM which includes the RS232, serial interface and cassette driving software as well as screen, colour and keyboard routines. BASIC is the old BASIC2 (which will consequently have the old garbage collection problem) with one or two re-

TODD'S VIEW

finements – for instance, 'null' INPUT (i.e. carriage return with no input provided) no longer aborts the program; instead execution continues with the next statement and the input variable is not affected. The SYS command is slightly different (and more useful), allowing the A,X,Y and status registers to be passed to and from machine code programs. Also, many hooks have been provided to allow interception of some of the interpreter's routines (e.g. the error handler has a hook which could be used as an error trap, thus allowing some sort of 'ON ERROR' command).

Many important operating system routines are available via a jump table at the end of the ROM. These will (should?) remain in the same place whenever new ROMs are released which should make software portability very much easier. This concept has been used for many years on some operating systems (such as CP/M) and is referred to as a KERNEL operating system (note the spelling!). In addition, many of these routines also have vectors in RAM which means that programmers can intercept them to incorporate their own routines.

Moving windows

I don't want to go into details of the VIC chip at this stage (it is far too complex to explain in a short article) – but it provides for some very versatile screen handling. For instance, you can move the 'window' around on the screen, change its width and height as well as having the screen, colour and character generator move to where you want them. Some POKEs are listed at the end to do some of these things – there will no doubt be more in the future.

RAM in the VIC is a curious affair – an unexpanded VIC has RAM up to \$1FFF with a gap between \$0400 and \$0FFF. The 3K expansion module fills this gap. Further RAM extension is added from \$2000 at which time the operating system re-orientates itself and moves the screen RAM from \$1E00 to \$1000. There is an additional bank of screen RAM at \$9400 to hold the colour codes for each character

position. It is intriguing to note that although this RAM is 4 and not 8 bits wide, it has a capacity of 1K – of which only half is used! A 40 column screen requires 1K. Interesting!

POKIng about

Finally, to some of the POKEs I promised – firstly, the VIC has three keys which you may want to inhibit – there is the STOP key, the character 'flip' keys (CBM + shift) and the RESTORE keys. They can all be disabled as follows:

SCREEN FLIP:

To DISABLE – PRINT CHR\$(8)

To ENABLE – PRINT CHR\$(9)

STOP key: (also stops the TI/TI\$ clock)

To DISABLE – POKE 788,194

To ENABLE – POKE 788,171

RESTORE key:

To DISABLE – POKE 37150,2

To ENABLE – POKE 37150,130

VIC chip registers can be altered as follows – remember that the RESTORE + RUN keys when pressed together will set the display back to normal) – if you make the screen too big you will run out of RAM and get some weird effects at the end of screen. This can be cured, and won't occur on expanded VICs:

POKE 36864,X (where X < 128)

Moves the screen window horizontally (X starts at 12)

POKE 36865,Y

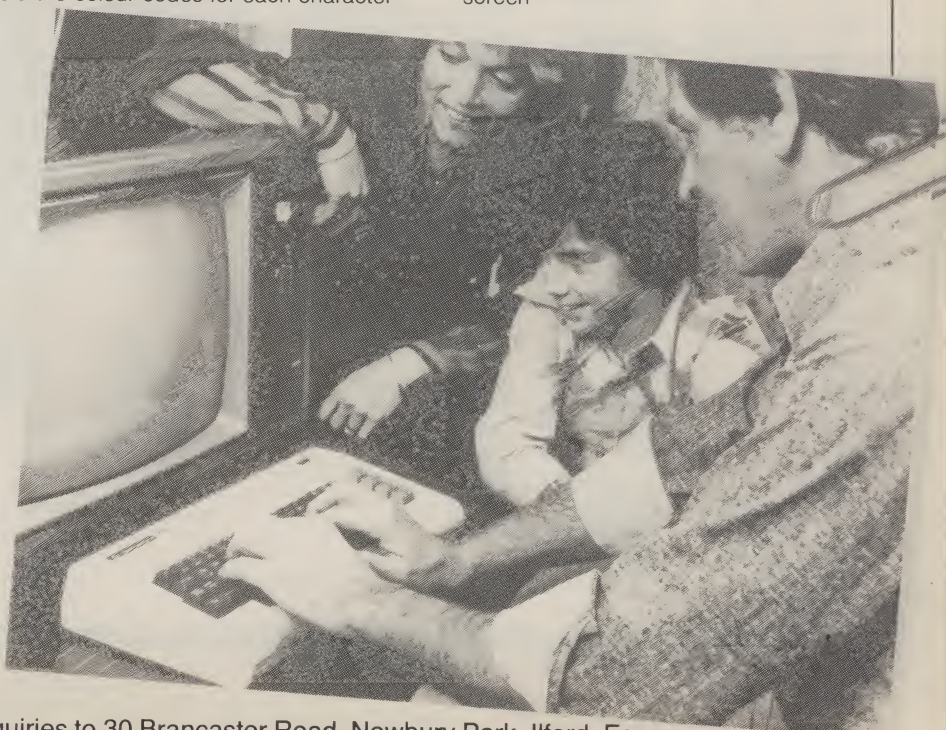
Moves the screen window vertically (Y starts at 38)

POKE 36866, W OR 128

Sets the number of characters on a line (if the right hand edge runs off screen you will get some corruption – try moving the window to the left)

POKE 36867, H*2 OR 128

Sets the number of character lines on the screen





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Most programmers agree that standards are A Good Thing. The problem is that no two programmers ever agree on what those standards should be!

With the VIC only just arriving, we have the opportunity to make some suggestions right at the start, before we all go mad writing software. **Maldwyn G. Morris** proposes a set of standards for the use of VIC's variables.

Now that the most privileged among us have our long-awaited VICs, it seems the moment to be setting standards for the many programs that are likely to arrive for it.

I propose that all programs written for publication employ a standard set of variables for important values, as this will aid understanding and conversion of software.

Below I have detailed just some possible ideas for standardisation – the basic concept can, of course, be extended much further.

VIC Variables

Variable Name(s)	Use	Value (if constant)
I,J,K,L,M,N and permutations such as I8, I9, JM, JN, I0 etc.	FOR-NEXT loops	—
R0 (register 0)	To contain the address of VIC CONTROL REGISTER 0	36864
R1 (register 1)	To contain the address of VIC CONTROL REGISTER 1	36865
	and so on, up to:-	
RF (register F)	To contain the address of VIC CONTROL REGISTER F	36879
SB screen, border	For the value in RF that controls the screen background and border colours (from the table in the VIC manual). N.B. This can also be obtained by adding the screen colour poke code *16 to the border colour poke code, and then adding 7.	
PC Poke Colour	Poke value of colour = keytop number - 1	(0-7)
CL\$ colour string	Contains the control characters of all the colours. This can be used by:- MID\$(CL\$,PC+1,1)	
CP character Poke	Poke code of character	0-255
KM key matrix	Address of matrix value of key being held down	197

CT Character, Top	Address of top-left corner of 'character screen'	7680 (but changes with added memory)
TC top, colour	Address of top-left corner of 'colour screen'	38400
OF offset	Difference between TC and CT	(usually) 30720
DN down	Number of cursor Downs req'd. Down string containing 23 programmed Cursor Down characters used by LEFT\$(DN\$,DN); similarly RT,RT\$ (right) UP,UP\$ (up) LT,LT\$ (left)	0-23
DN\$ down string		
CX, CY Cursor X, Cursor Y	Cursor co-ordinates, using X,Y from top-left of screen	0-21 (CX) 0-22 (CY)
F1 Freq 1	Value in RA that controls the frequency of Voice 1	0-255
F2 Freq 2	Similar for RB, Voice 2	0-255
F3 Freq 3	Similar for RC, Voice 3	0-255
FN Freq Noise	Similar for RD, Noise Voice	0-255
VL Volume	Volume of voices in RE	0-15
LH, LV	Light pen horiz/vertical in R6, R7	
PX, PY Pot.X, Pot.Y	Potentiometer X/Y in R8, R9	
FM Free memory	RAM Memory of computer with no program.	3.5K-30.5K
UM	RAM Memory used by program	0K-30.5K
GT\$ Get string	Value used in GET waiting loops such as:- 1000 GET GT\$:IF GT\$ <> " " THEN 1000 to wait for a space	
DE Delay	Value used in delay loops such as 2000 FOR DE = 1 TO 10000: NEXT DE	
FNR(X)	INT(RND(1)*X)+1 generate an integer random number in the range 1-X	

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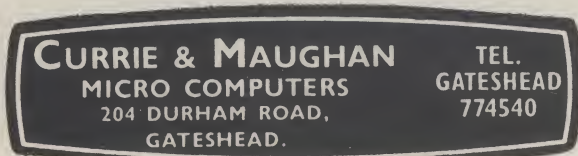
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In part 2 of his series for people who thought they could never learn to program a computer, **Mike Gross-Niklaus** shows how the VIC can take decisions, and uses this idea to create a simple Rocket Countdown program.

In Issue 0 of *VIC Computing* you saw how to write, enter and run a simple program using the BASIC keywords INPUT, LET and PRINT and the Commands NEW, LIST and RUN.

I left you with two problems. The first was to work out from the given listing what a program did, and the other was to write a weekly calorie accounting program.

We'll look at the solutions to these problems, then go on to see how the VIC can make decisions.

What does the listed program do?

The problem was to discover what the program in Listing 1 achieved. Lines 10 and 20 ask you for the width of a room in feet and put your response into variable RW.

Lines 30 and 40 ask you for the room's length in feet and put the response into variable RL.

Line 50 calculates the area of the room in square yards by multiplying the width by the length and dividing by 9 (9 square feet = 1 square yard) and puts the result in variable AR.

```
10 PRINT "WIDTH OF ROOM IN FEET"
20 INPUT RW
30 PRINT "LENGTH OF ROOM IN FEET"
40 INPUT RL
50 LET AR = RW*RL/9
60 PRINT "HOW MUCH IS THE"
70 PRINT "CARPET PER SQUARE"
80 PRINT "YARD"
90 INPUT CP
100 LET TC = AR*CP
110 PRINT "THE TOTAL COST OF"
120 PRINT "CARPETING THE ROOM IS"
120 PRINT TC
```

LISTING 1

Lines 60, 70 and 80 ask for the price of carpet per square yard and put your response into variable CP.

Line 90 calculates the cost of carpeting the room by multiplying the area in square yards by the price per square yard and puts the result into variable TC.

Finally, lines 100, 110 and 120 display a message on the screen telling you the cost of carpeting the room.

You can run the program as many times as you like, responding with different room sizes and carpet costs, Axminster for the living room and lino for the Loo for example. In other words, the listing is for a General Purpose Carpet Cost program. Full marks to those of you who got it right.

A weekly calorie accounting program

We need to input the calories for each day of the week, total them, divide the total by 7 and print out the result as the average daily calorie consumption. The only BASIC keywords we have available at the moment are INPUT, LET and PRINT so the program will have to per-

form the task in a very straight-forward and rather long-winded manner. Listing 2 shows one way of programming the problem.

```
10 REM WK. CAL. ACC.
20 TC=0 REM TOT CALS=0
30 PRINT "SUNDAY INTAKE"
40 INPUT CI LET TC=TC+CI
50 PRINT "MONDAY INTAKE"
60 INPUT CI LET TC=TC+CI
70 PRINT "TUESDAY INTAKE"
80 INPUT CI LET TC=TC+CI
90 PRINT "WEDNESDAY INTAKE"
100 INPUT CI LET TC=TC+CI
110 PRINT "THURSDAY INTAKE"
120 INPUT CI LET TC=TC+CI
130 PRINT "FRIDAY INTAKE"
140 INPUT CI LET TC=TC+CI
150 PRINT "SATURDAY INTAKE"
160 INPUT CI LET TC=TC+CI
170 AV=TC/7
180 PRINT "AVERAGE CALORIES"
190 PRINT AV
```

LISTING 2

Line 10 introduces a new BASIC KEYWORD, 'REM'. REM acts like a foot-note or stage direction to anyone who LISTs the program rather than RUNs it. You can use it to title your programs as in line 10, or to explain what is happening as in line 20. When a program is running and the VIC meets a REM, it doesn't bother with anything else on the line, but starts processing the next one. If you think I'm cheating to introduce a new KEYWORD to solve the problem, delete line 10 by typing 10 and pressing the RETURN key. The program will still RUN and perform properly. It's always a good idea to head up your programs with a REM statement, for the same reasons that a book is given a title.

We are going to use variable TC to accumulate the total calories for the week. In the same way as you might shake out the dust from a suit-case before filling it with clothes, you must make certain TC is zero before starting to add things into it. Now typing RUN will automatically set all variables to zero, so you may think that line 20 is unnecessary. For this program you are right! But later in this article you will see how to go back to the start of a program in a kind of loop to perform the program over again, in which case a variable will be zero the first time round but not necessarily the second time. It's a good habit, like using your indicators for a right turn in your car even when no other traffic is in sight, to zeroise variables which are going to be used to accumulate totals.

Line 30 displays on the screen a request for you to type in your calorie intake for Sunday, and line 40 contains the actual INPUT statement. When you press the RETURN key, your response will be placed in variable CI.

Notice that line 40 has two BASIC statements separated by a colon ':'. You can put as many statements into a line as will fit into 88 characters (four lines on VIC's screen), provided you separate them with colons.

The second statement on line 40 may seem a bit peculiar, but spell out the LET statement like I did in Issue 0:-

Let the value in variable TC become the old value in TC plus the value in CI.

In other words the value in CI is added to the current total in TC to maintain a running total in TC.

Lines 50 and 60, and onwards up to line 160 duplicate lines 30 and 40 for the other days of the week. Notice that variable CI is used each time. When you place a value in a variable it wipes out the previous value. However, when you use a value from a variable to calculate something, only a copy is used and the original value remains. So each time a value is input into CI, it wipes out the previous value.

Line 170 looks like a LET statement with the LET missing. And that is exactly what it is!! Line 170 could be written:-

```
170 LET AV=TC/7
```

The LET statement is so common that the VIC allows you to leave the word LET out if you want to. This saves space in VIC's memory.

Lines 180 and 190 display the average daily calories for the week.

You could run this program for every week in the year and for every person in the family. It's a general purpose Average Daily Calories Program.

Program Looping

It's a bit of a chore having to type RUN each time you want to enter a new set of values into the Carpet Costs program or the Daily Calories program. Computers are intended to eliminate the 'boring bits'. What can the VIC do to help us here?

When a program is RUN, each line is normally processed in turn, starting with the lowest numbered line and finishing after the highest numbered line. BASIC has a keyword, GOTO, which stops this normal regression and defines at which line the processing will continue. For example, look at Listing 3.

```
10 C=0
20 C=C+1 PRINT C
30 GOTO 20
40 REM THE PROG NEVER
50 REM GETS TO HERE!
```

LISTING 3

Line 10 zeroises the variable C. Line 20 increases C by one and prints its current value. Line 30 causes the normal processing progression to be interrupted. Instead of line 40 being obeyed next, line 20 is processed. So the program LOOPS round lines 20 and 30, printing out on the screen ever-increasing numbers. How do you stop the program? Have a look at the left-hand end of your VIC keyboard. See the RUN/STOP key? Press it

ANYONE CAN P

and the program will stop.

'What If...' Programs

You can use GOTO to create programs which allow you to set up some values, calculate a result and then alter the values or some of them until you get a result that pleases you. For example, in the Room Carpeting program, suppose you have a choice of several prices of carpet for your living room. You can use GOTO to set up the program to ask "What if I buy a cheaper (or more expensive) grade of carpet than the one I've just entered; how will that affect the final price?"

Have a look at Listing 4.

```
10 REM ROOM CARPET W2
20 PRINT "WIDTH IN FEET" INPUT RW
30 PRINT "LENGTH IN FEET" INPUT RL
40 AR=RW*RL
50 PRINT "PRICE/SQ YD " INPUT CP
60 CC=AR*CP
70 PRINT "CARPET COST" PRINT CC
80 GOTO 50
```

LISTING 4

```
10 REM SIMPLE ARITHMETIC
20 PRINT "ENTER A NUMBER LESS"
30 PRINT "LESS THAN 100" INPUT H
40 PRINT "NOW ANOTHER NUMBER"
50 PRINT "WHICH BRINGS THE "
60 PRINT "TOTAL UP TO 100"
70 INPUT M
80 IF H+M=100 THEN GOTO 200
90 PRINT "WRONG I'M AFRAID"
100 PRINT "YOU NEEDED"
110 PRINT "100-M"
120 GOTO 30
200 PRINT "WELL DONE"
210 GOTO 20
```

LISTING 5

Lines 10 to 70 perform the same functions as the previous version of the program. But look at line 80. The GOTO statement transfers processing back to line 50, which asks for a new carpet price per square yard. The room dimensions, RW and RL, and the room area in square yards, AR, remain the same. The program uses the same area to recalculate the cost of carpeting the room using a different price for the carpet per square yard. You can continue to loop around the program, inputting prices for different grades of carpet until you arrive (hopefully) at a carpet grade and a final cost which are both acceptable to you.

You will find it a little difficult to break out of this program. The STOP key doesn't do its stuff during an INPUT, and the program spends very little time printing and calculating. Look on the right hand end of the second row of keys – you will see one marked RESTORE. To break out of a VIC program while it is waiting for INPUT, hold down the RUN/STOP key and press the RESTORE key. The screen colours will be restored to their 'Power up' conditions, the screen will clear and you will see the word READY and the flashing cursor, just as if you'd just switched on the VIC. But type LIST and you will find that the program is still there, intact and ready to RUN.

Getting VIC to make decisions

Suppose you are reading the paper after breakfast on Saturday morning. "Fred", shrills your dearest, "What are you going to do this morning?" In true chauvanistic fashion you might reply, "If it's fine then I will wash the car. Otherwise I will continue to read the paper."

Since this is an example for a computer programming concept, you will forgive me if I break down and analyse your statement in programming terms.

'If' signals there is a choice of action.

'it is fine' is a condition which may or may not be fulfilled. In computer terms we say that the condition is *true* or *false*.

'then' signals what you are going to do if the condition is true.

'I will wash the car' is what you are going to do if the condition is true.

'Otherwise' signals what you are going to do if the condition is not true.

'I will continue reading the paper' is what you are going to do if the condition is not true.

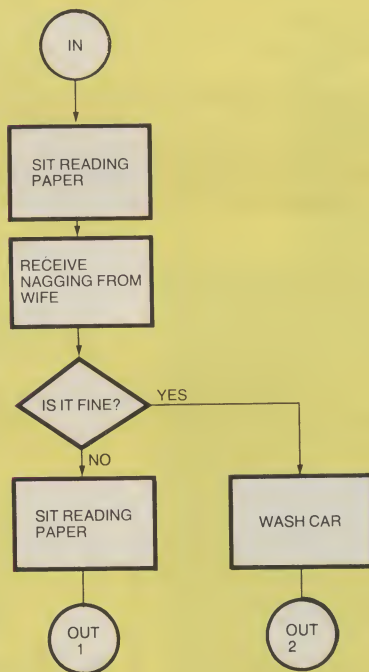


DIAGRAM 1

The Flow Chart in diagram 1 illustrates the steps involved in making the decision.

The VIC can chose between actions in much the same way. Have a look at listing 5.

Lines 20 and 30 get you to enter any number less than 100.

Lines 40-70 allow you to enter another number which added to the first number results in a total of 100, or so you hope!

Line 80 checks to see if you were right.

Notice that the words IF and THEN are used just as in your Saturday Morning decisions. If your answer was right, then processing branches to line 200, where you are told 'Well done' before processing again jumps, this time back to the start for another problem.

There is no 'Otherwise' statement in VIC BASIC. Instead, VIC assumes that if the Condition is not true, you want processing to continue with the next line following the IF statement. For example, suppose you INPUT into N a value of 70 and a value of 20 into variable M. The condition in line 80 is 'N+M=100' which in this case is not true. So processing continues with lines 90-120 where you are informed of your error before the program jumps back for another problem.

The IF statement in BASIC is made up as follows:-

IF condition THEN statement(s)

The condition can use other relationships besides '='. BASIC allows the following:-

- = Equal to
- < Less than
- > Greater than
- <= Less than or equal to
- >= Greater than or equal to
- <> Not equal to

Remembering from Issue 0 that you can squeeze in extra lines provided you have left an interval between your line numbers, you can add a check to the SIMPLE ARITHMETIC program to ensure the initial value is less than 100. Listing 6 shows one method.

```
20 IF N<100 THEN GOTO 40
30 PRINT "LESS THAN 100!"
35 PRINT "IDIOT!!!" GOTO 30
```

LISTING 6

```
10 REM COUNT UP
20 C=0
30 C=C+1 : PRINT C
40 IF C<100 THEN GOTO 30
```

LISTING 7

You can also use IF...THEN to count up to a desired value. Listing 7 shows a program which counts to 100 then stops.

Listing 8 simulates a rocket count down. The trouble with this program is that the VIC works a lot quicker than the folks at Cape Canaveral. But again you can use IF...THEN counting to slow things down by inserting extra lines which count nothing in particular for about a second. Listing 9 shows the details. I had to experiment a little with the value in line 36 to give a delay of about a second.

▷ 23



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right! Additional bonus - power supply voltages are externally available.

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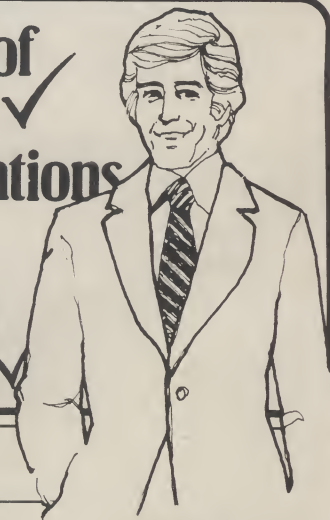
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21

ANYONE CAN PROGRAM

continued

Homework!

As an exercise, why don't you try adding extra lines to SIMPLE ARITHMETIC to turn it into a game with ten turns, and a score of correct answers out of ten displayed at the end of the game.

Next time we'll compare notes on this simple game, show how you can input words into your programs, and learn about saving programs on cassette.

```
10 REM ROCKET COUNT
20 C=11
30 C=C-1 : PRINT C
40 IF C=0 THEN GOTO 30
50 PRINT "WE HAVE LIFT OFF!!"
```

LISTING 8

```
60 DE=0
70 DE=DE+125
80 IF DE<500 THEN 34
```

LISTING 9

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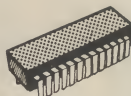
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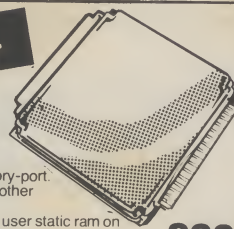
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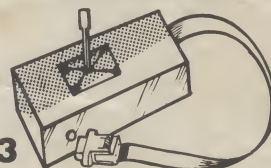
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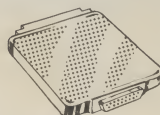
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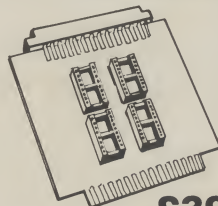
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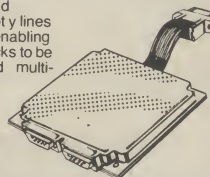
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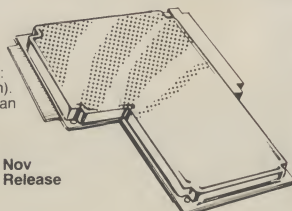
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CMOS (low power)		NMOS (low cost)		Nov Release
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8k plus 3k	£103	8k plus 3k		
16k	£124	16k		
16k plus 3k	£146	16k plus 3k		
24k	£167	24k		
24k plus 3k	£184	24k plus 3k		
1 RAM	£11.50			



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